## Space Weather Forecast

Issued on Friday, 23 September 2022 at 13:07 Local

**This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: Lowered chance of Minor Geomagnetic Storm G1 at first, but increased later in four days due to possible CME arrival(s). Continuing daily chance of Minor Radio Blackouts (R1).**

### Analysis of Space Weather Activity over past 24 hours

**Solar Activity:** Solar activity has been low, with a slow undulation in background X-ray flux in low common-class, interspersed by more sizeable mid-common-class activity. The peak of these flares was a late, mid-ranking common-class flare observed at 23/1133UTC from a new region on the northeastern horizon; else being a slightly smaller common class flare at 23/0339UTC, with this appearing to emanate from the smaller of a pair of sunspots in the southeastern portion of the Sun. This group was one of up to six on the current facing side, with an areally larger and hitherto more active group to its immediate northwest, with a complex magnetic designation not capped by any activity increase. A new region appeared on the northeastern solar horizon in the period, while the other spots on the front side were less notable.

Satellite imagery in the period was dominated by a large, wide-angled but apparently slow Coronal Mass Ejection (CME), first visible from late morning UTC on 22 September. This CME has been analysed at length and is now thought likely to be related to the then-rapid emergence of a central sunspot region, with the CME inferred as probably parting around the dawn period UTC on 22 September. The latest MOSWOC modelling of this CME puts arrival of this feature around 26/0100UTC, i.e. the turn of the UTC day Sunday 25 September into Monday 26.

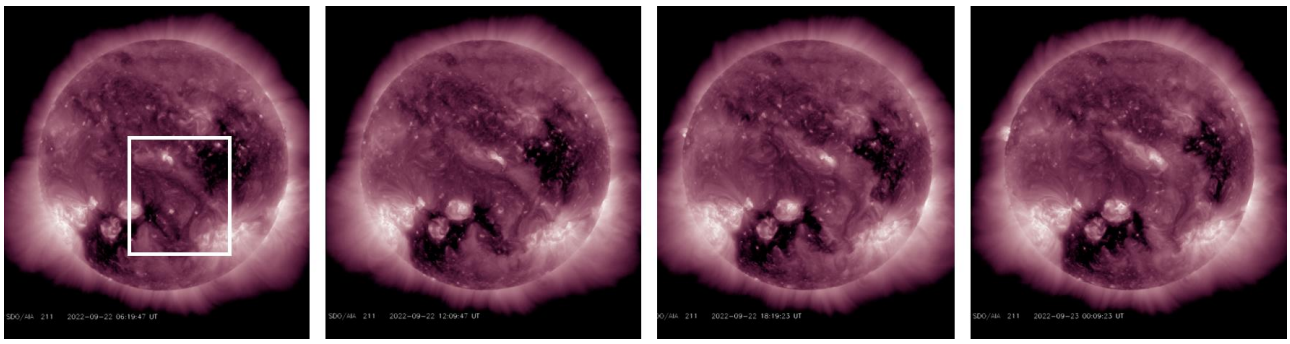

**Figure 1: False-colour six-hour cadence extreme UV time sequence, showing a retrospective potential 'filament channel-like' feature (boxed), immediately southwest of an emerging sunspot centre-disc (white pixels near centre of image (sunspots are bright in this wavelength of light)).**

**This is a speculative attribution for the CME seen heading mainly north and west of the Sun-Earth line through the UTC day of 22 September. Modelling has this feature's potential arrival around 26/0100UTC.**

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An earlier faint CME from the southeast of the Sun on 21 September should (narrowly) maintain its independence as a resolved feature, perhaps arriving as a glancing blow just ahead of its sibling later on 25 September. Both events carry low confidence, but are the only CMEs in the forecast at present.

A small 'filament' was seen to leave the southwest of the Sun at low solar latitudes around 22/1500UTC, however this did not appear in subsequent imagery and has likely been re-absorbed.

**Solar Wind / Geomagnetic Activity:** The solar wind was of uncertain character, and may be reflective of a hesitant connection to a slower than anticipated fast wind from a 'coronal hole'.

The solar wind speed exhibited a slow decline at first in the 24 hours, but showed a discontinuity and subsequent rise from 22/1700UTC, with a further jump at 22/2100UTC to a Slightly Elevated peak. Following this, an overall decrease was observed, but with an erratic character. The number of particles comprising the wind was variable, peaking at Slightly Elevated immediately before the main speed increase and repeating around 23/0130UTC, but otherwise with an ensuing decline. The magnetic field associated with the wind peaked at slightly elevated levels through the middle of the reporting period, attenuating slightly into the current UTC day.

The net result of the above solar wind measures was for provisionally mainly quiet geomagnetic activity.

**Energetic Particles / Solar Radiation:** No solar radiation storms were observed, remaining very close to background levels on a downward trend.

## Four-Day Space Weather Forecast Summary

**Solar Activity:** Solar activity is forecast to be low to moderate, with further common-class flares expected and a with an ongoing daily chance of moderate-class flares. The main flare risk remains from the southeastern quarter of the Sun.

**Solar Wind / Geomagnetic Activity:** This forecast period comprises an imminent or possibly current coronal hole fast wind, and up to two low confidence CMEs on days three and four (Sunday 25 and Monday 26 September).

Of the two CMEs, the second carries a more confident Earth-bound trajectory (although still with significant uncertainty). Current MOSWOC modelling solutions maintain these two CMEs as distinct features (just) with arrivals late in the UTC of 25 September and around the turn of the UTC day of 26 September. These CME should serve to prolong the tail of risk from the coronal hole fast wind.

The net effect of the above is a peak chance of Minor Storm G1 in the next 24 hours and again between the UTC days of 25 and 26 September, else falling to a slight chance.

**Energetic Particles / Solar Radiation:** No solar radiation storms are expected, although there is a very slightly increasing risk due to the usual westward advance of the more active sunspot groups across the facing side of the Sun.

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**Geomagnetic Storms:**

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 40 | 20 | 10 | 30 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

**Radio Blackouts - X Ray Flares:**

| X Ray Flares Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 M Class | No | 40 | 40 | 40 | 40 |
| Very Active | R3 to R5 X | No | 5 | 5 | 5 | 5 |

**Solar Radiation Storms - (High Energy Protons):**

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | ≥ S1 | No | 2 | 2 | 5 | 5 |
| Very Active | ≥ S3 * | No | 1 | 1 | 1 | 1 |

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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